



# DRAW

Dynamic Routes for Arrivals in Weather

Concept and Trial Planning Overview

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NASA Ames Research Center



# Today's Arrival Operations

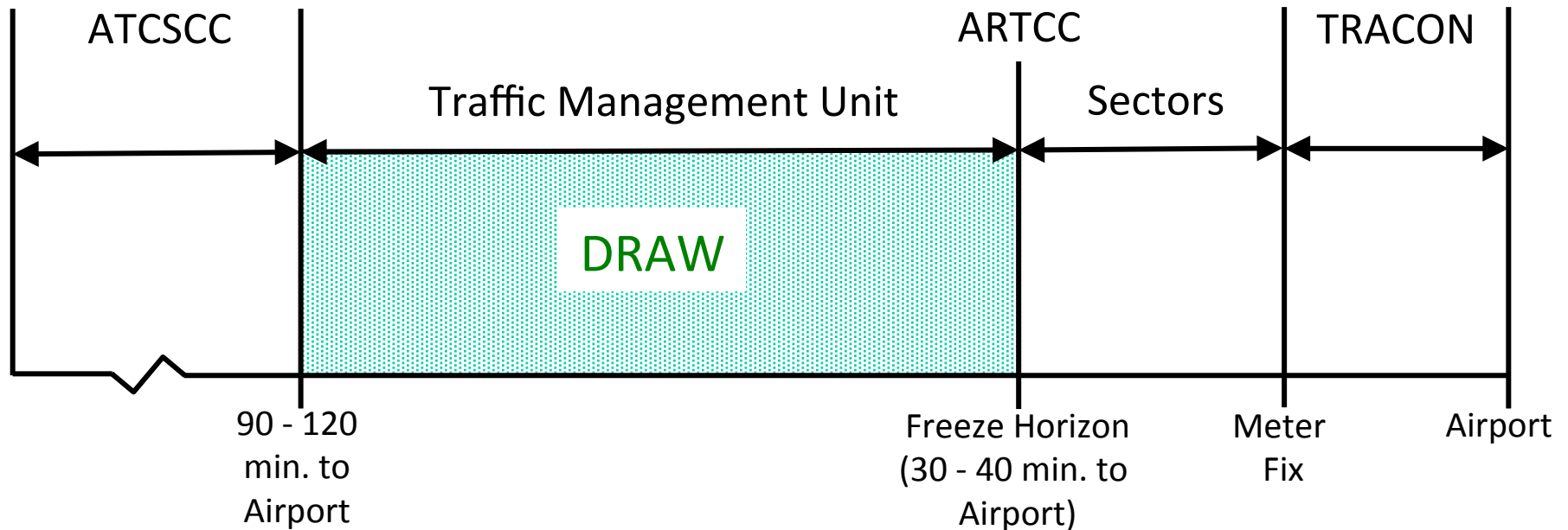
- Weather is one of the primary reasons for time-based metering to be discontinued
- Current operational system cannot adjust its scheduled times of arrival (STA) for aircraft that need to deviate around weather
- Traffic Managers and Controllers revert to less efficient methods of managing arrival traffic flow in weather
  - Implement conservative alternate routes hours in advance
  - Miles-in-trail (MIT)



# What is DRAW?

Traffic management decision support tool that proposes reroutes to improve arrival traffic flow

- Sustain metering operations in the presence of weather
- Find efficient arrival routes
- Balance meter fix demand





# DRAW System

## Planview GUI

## DRAW Advisory List

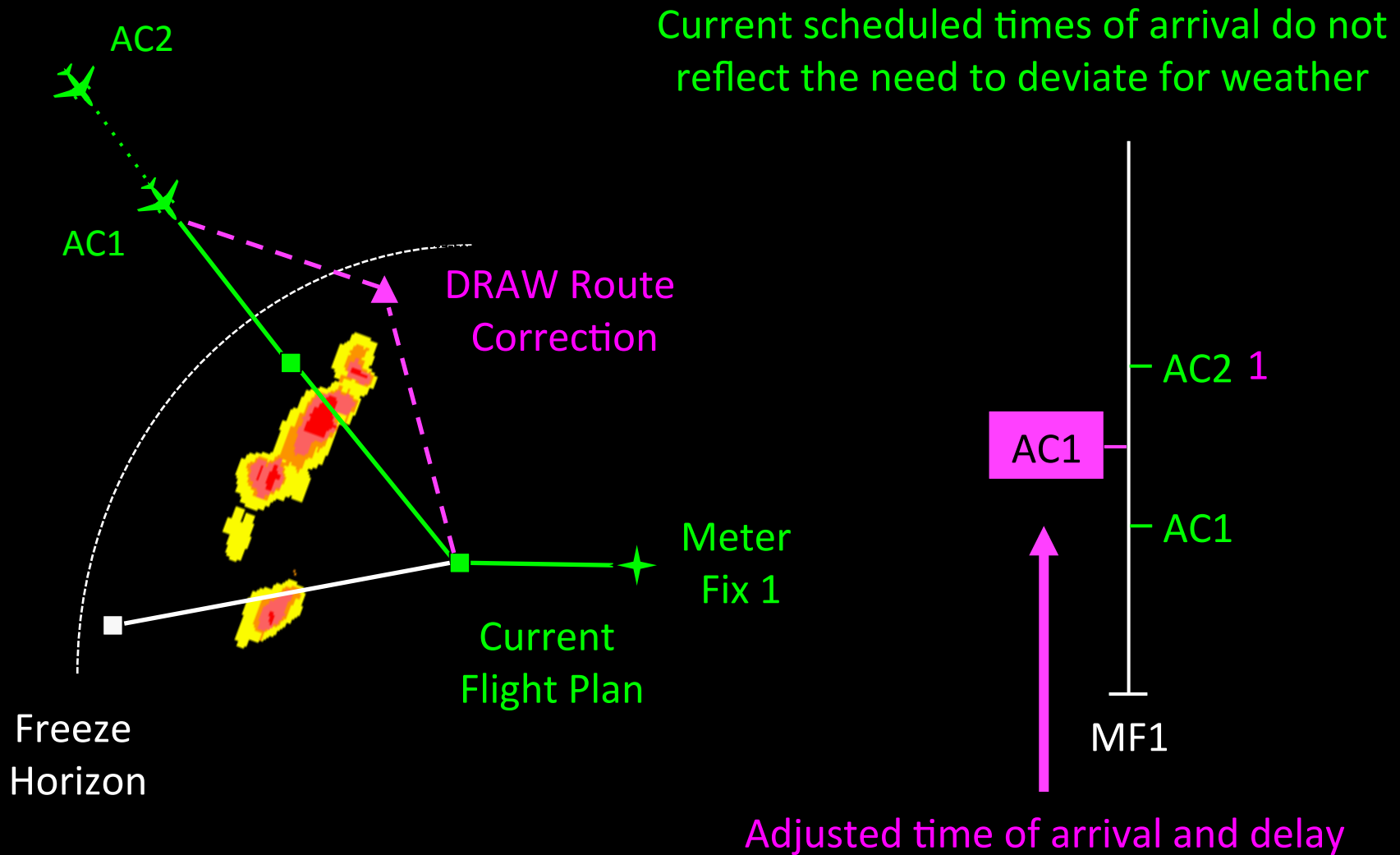
## Trial Planner

## Timeline GUI

- Planned as future TBFM enhancement
- Integrated Route and Schedule Trial Planner
- Two-hour convective weather forecast updated every five minutes
- Hourly atmospheric updates (e.g., winds)
- ERAM traffic feed from home and adjacent Centers
- Reroute candidate automatically identified and posted on DRAW Advisory List

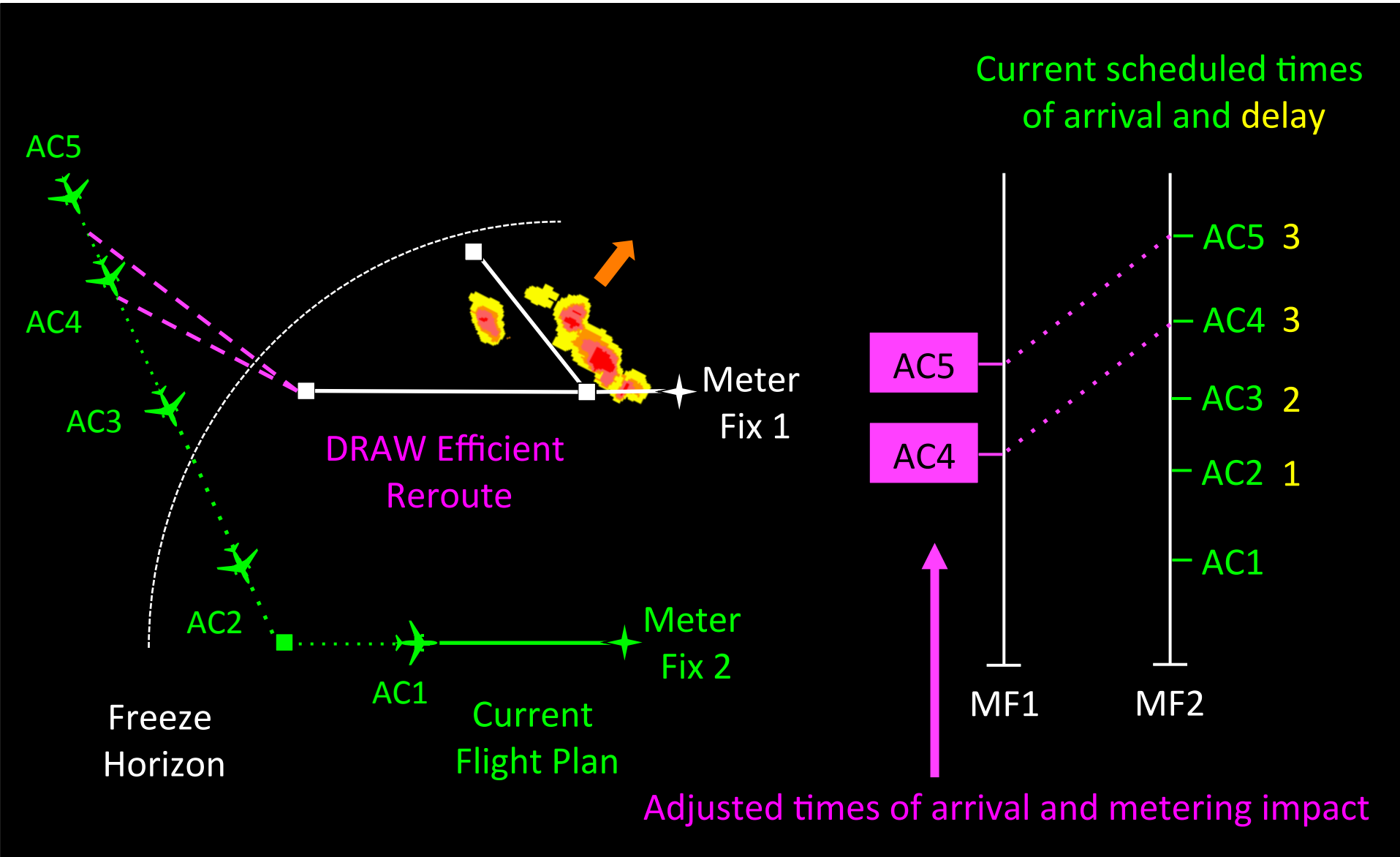


# Route Correction to Avoid Weather and Maintain Accurate Schedule Time of Arrival



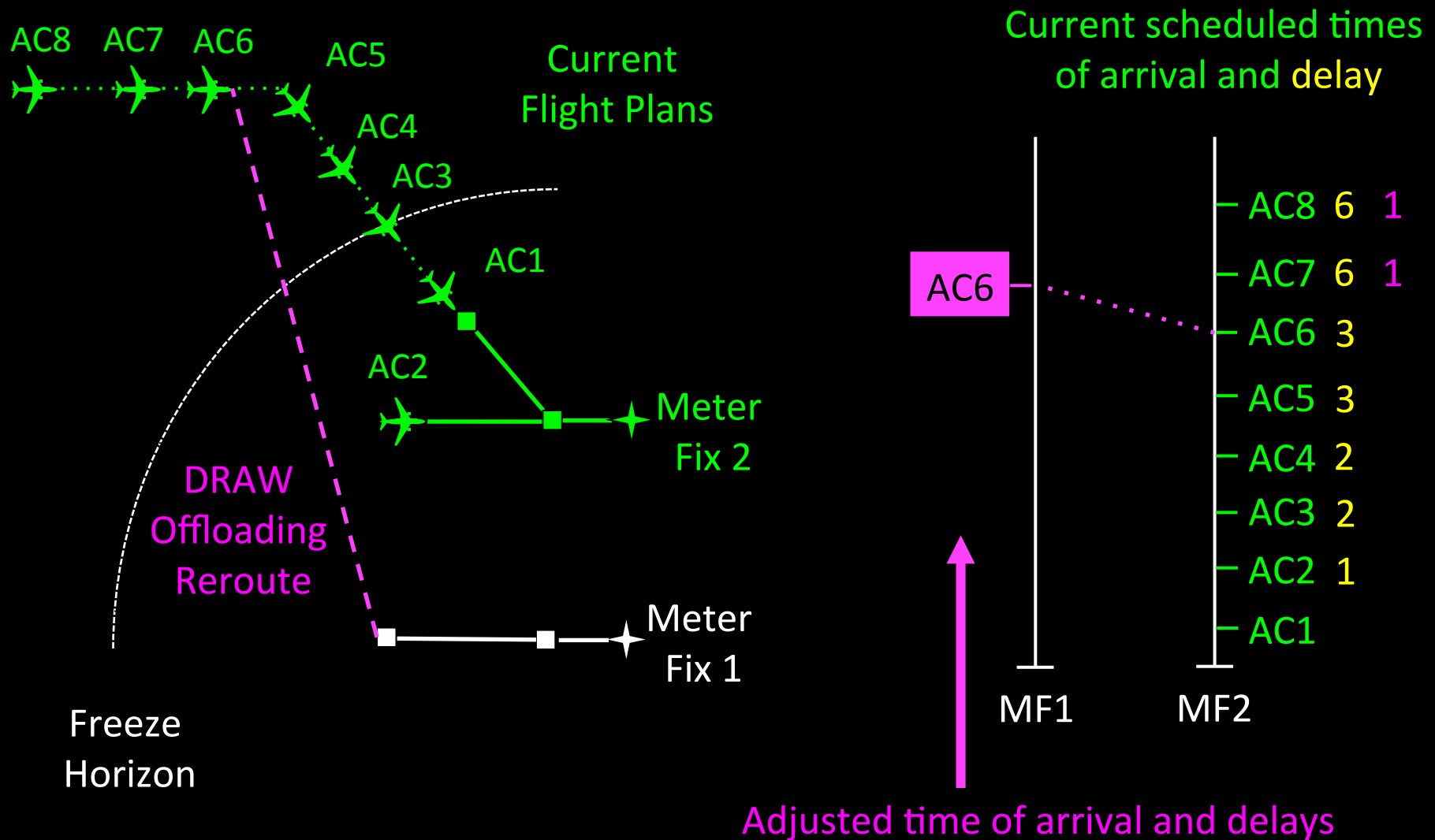


# Time Saving Reroutes to Alternate Meter Fix





# Meter Fix Demand Balancing (future capability)





# DRAW Advisory List

Individual Advisory

Group Advisory

Current Arrival Route

Time Savings

Proposed Arrival Route

TL	TP	GP	ACID/TYPE	DEP/TRAN.STAR.DEST	SAV	TRANS.STAR/AUX	STATUS
<input checked="" type="checkbox"/>			DEBBB   GREGS				
	<input type="checkbox"/>		SWA662/B738	KOAK/STNLI.JFRYE3.KDAL	0.1	GREGS.JFRYE3	OK
<input checked="" type="checkbox"/>			FEVER   BOOVE   KNEAD				
	<input type="checkbox"/>		VRD878/A320	KLAX/BGTOE.BACHR3.KDAL	-0.8	KNEAD.BACHR3/1	OK
	<input type="checkbox"/>		SWA290/B733	KMAF/BGTOE.BACHR3.KDAL	0.2	ANGST.BACHR3	OK
	<input type="checkbox"/>		AAL1184/MD82	KDEN/GEEKY.BOOVE3.KDFW	17.5	MDANO.VKTRY1	ALT
	<input type="checkbox"/>	<input type="checkbox"/>	AAL2533/MD82	KFAT/GEEKY.BOOVE3.KDFW	-1.0	BOOVE.BOOVE3/1	OK
	<input type="checkbox"/>	<input type="checkbox"/>	AAL2402/A321	KLAX/GEEKY.BOOVE3.KDFW	0.0	BOOVE.BOOVE3/1	OK
	<input type="checkbox"/>	<input type="checkbox"/>	AAL606/A321	KSAN/GEEKY.BOOVE3.KDFW	-0.9	BOOVE.BOOVE3/1	OK
	<input type="checkbox"/>	<input type="checkbox"/>	AAL1547/A321	KLAS/GEEKY.BOOVE3.KDFW	0.9	BOOVE.BOOVE3/1	OK
	<input type="checkbox"/>	<input type="checkbox"/>	AAL2207/A321	KSFO/GEEKY.BOOVE3.KDFW	2.3	BOOVE.BOOVE3/1	OK
	<input type="checkbox"/>	<input type="checkbox"/>	AAL2228/MD83	KSMF/GEEKY.BOOVE3.KDFW	1.6	BOOVE.BOOVE3	OK
	<input type="checkbox"/>	<input type="checkbox"/>	AAL2195/MD83	KTUS/GEEKY.BOOVE3.KDFW	-1.7	BOOVE.BOOVE3/1	OK
	<input type="checkbox"/>		ASQ2789/CRJ2	KMAF/GEEKY.BOOVE3.KDFW	-6.1	HNKER.VKTRY1	ALT
<input checked="" type="checkbox"/>			KARLA   BRDJE   SASIE   FINGR				
<input checked="" type="checkbox"/>			HOWDY   DODJE   ORVLL   YEAGR				

Grouped By Meter Fix

DRAW Status

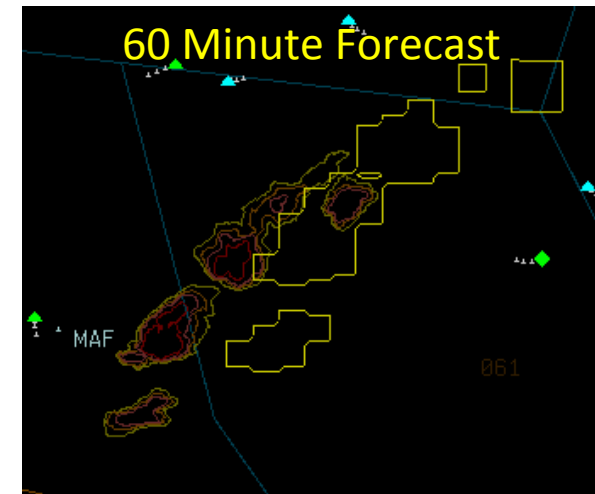
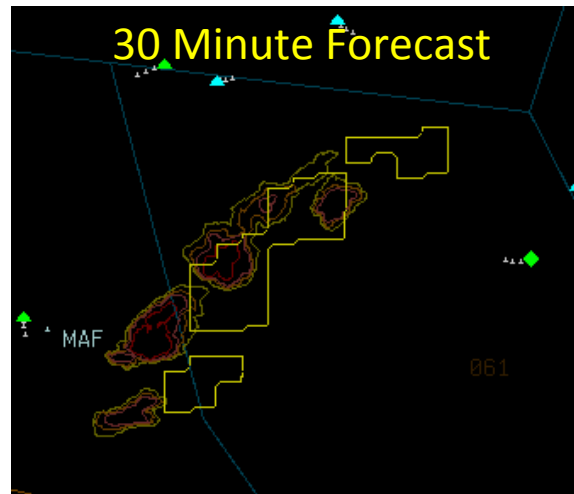
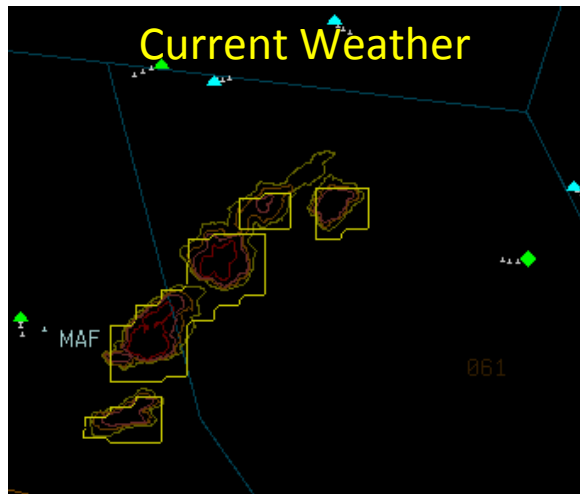
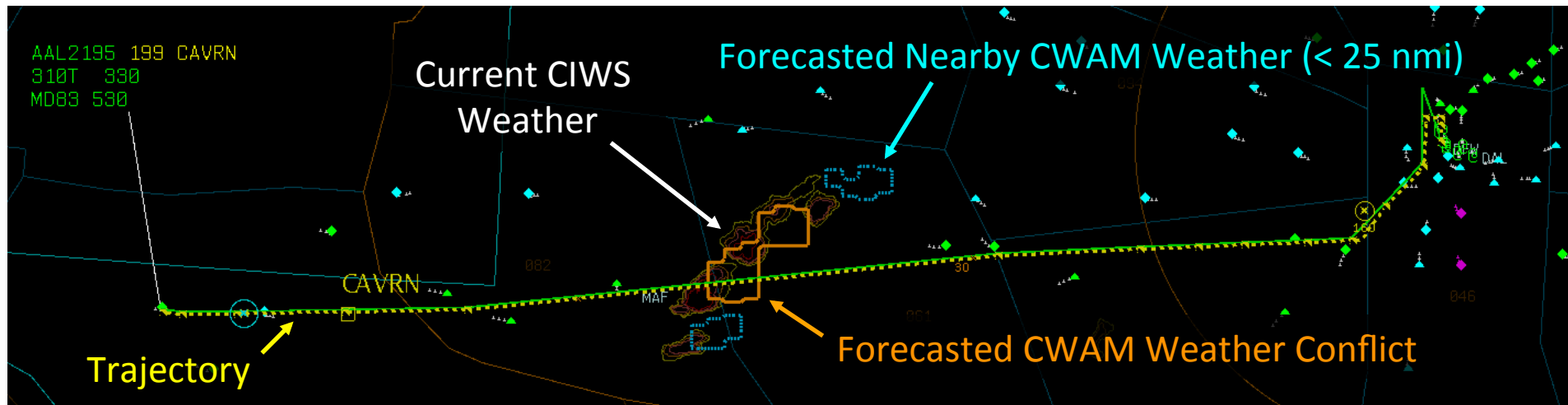
OK: Weather Deviation Route

ALT: Alternate STAR





# Trajectory Based Weather Modeling

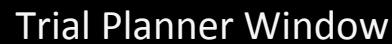
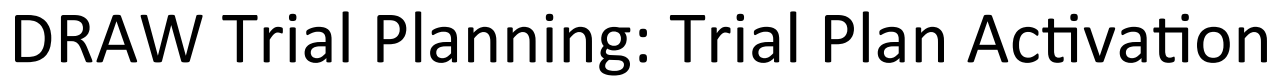


CIWS\*: Corridor Integrated Weather System (precipitation, echo tops)  
CWAM\*: Convective Weather Avoidance Model (pilot deviation model)

\*- Products of MIT Lincoln Laboratory

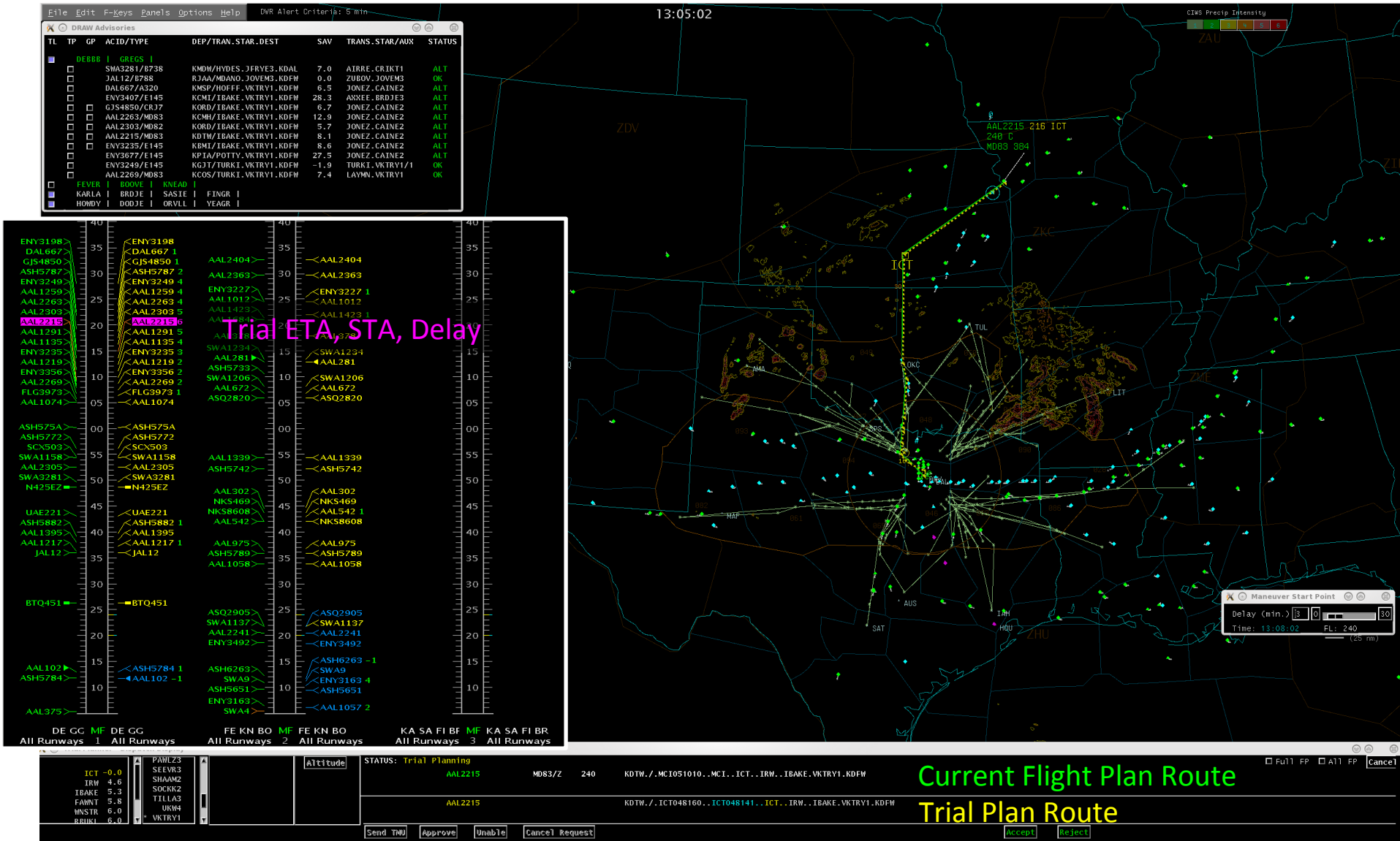


# DRAW Trial Planning



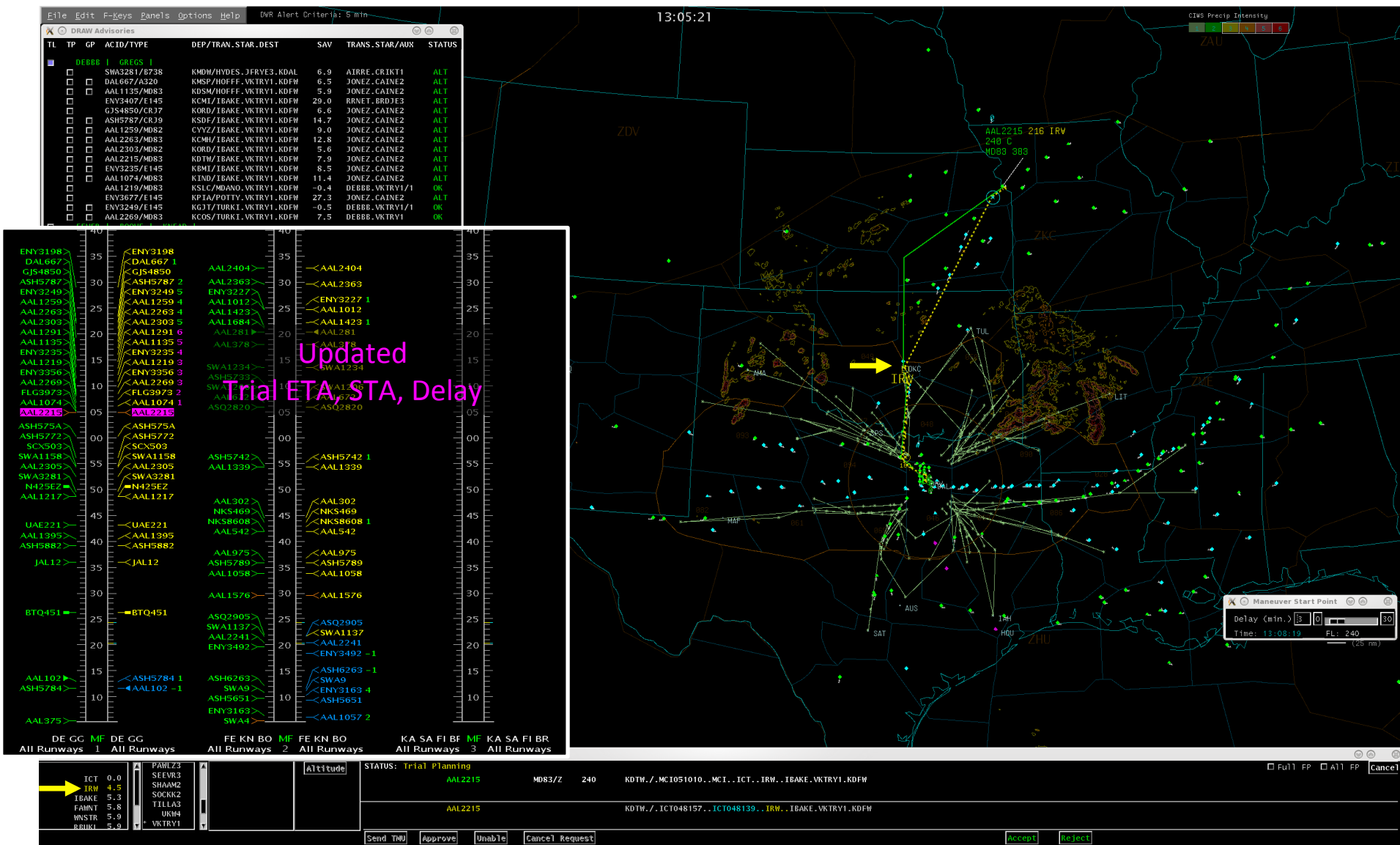


# DRAW Trial Planning: Current Flight Plan





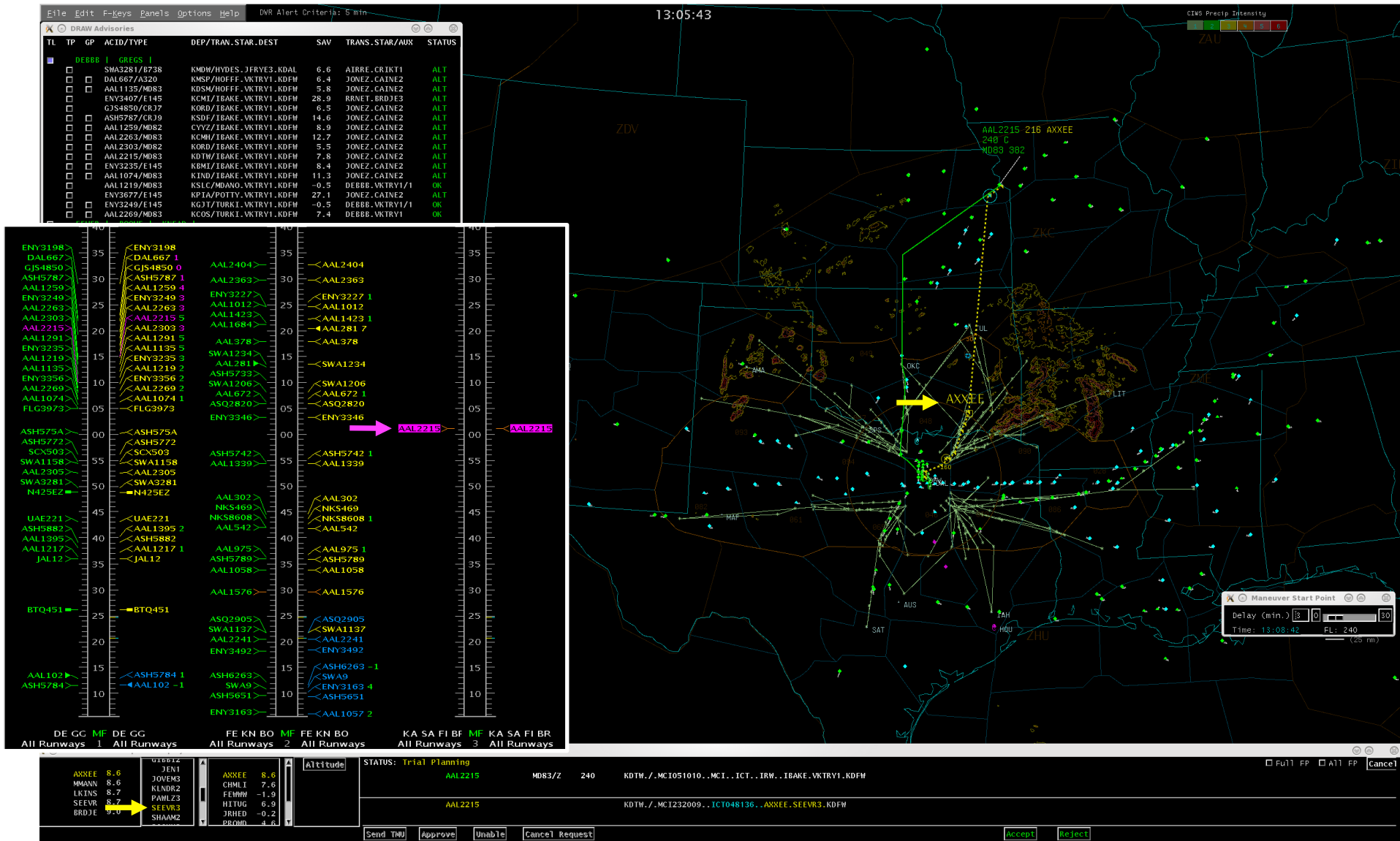
# DRAW Trial Planning: Capture Waypoint



Capture Waypoints



# DRAW Trial Planning: Alternate STAR

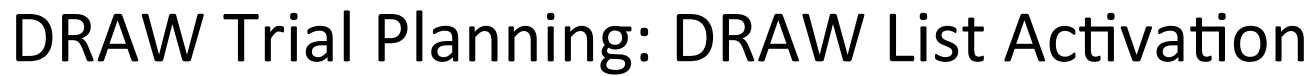




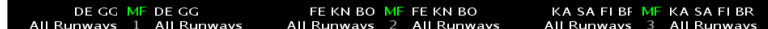








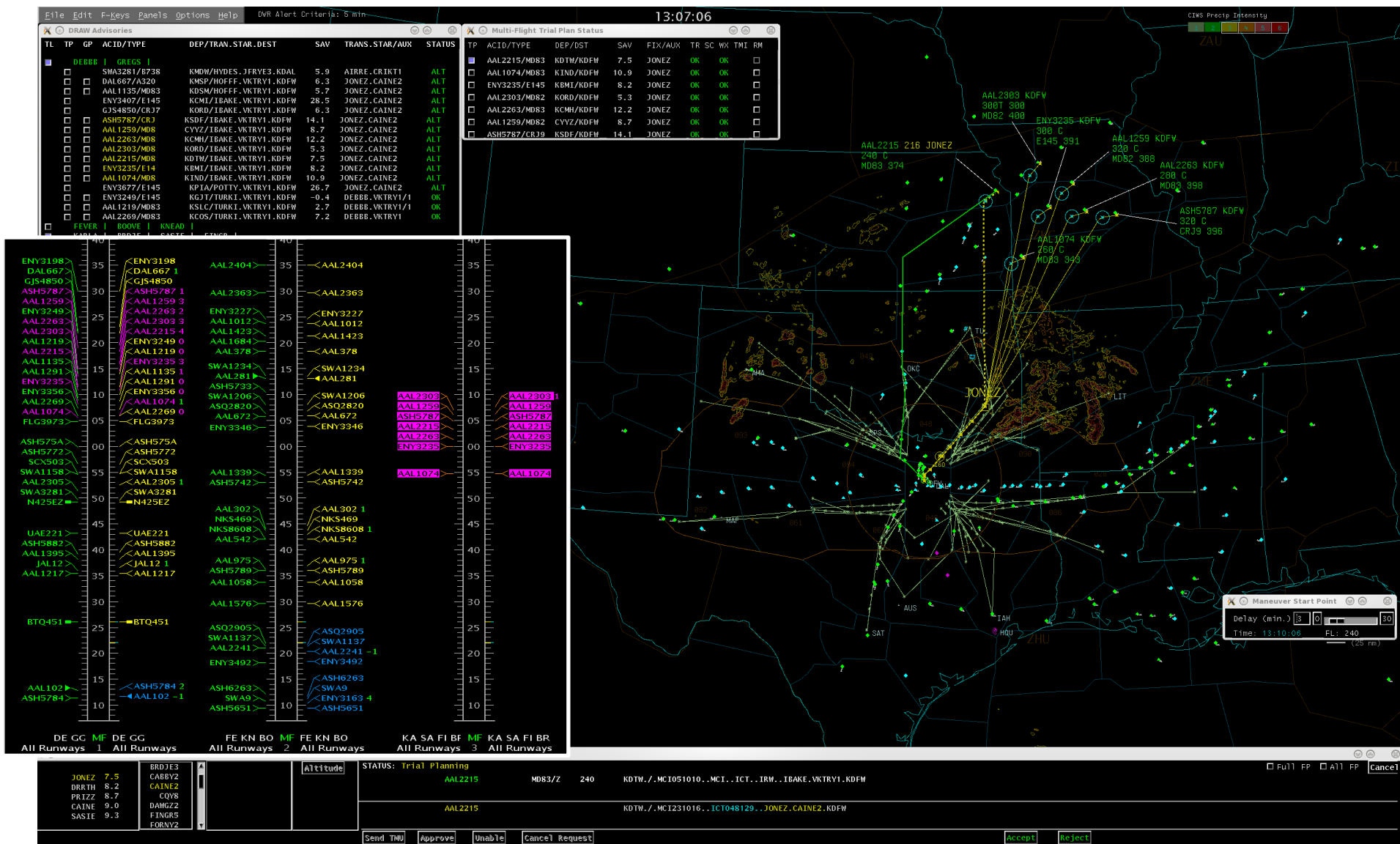
4407/F145	KCMR/TBAKE.VTRY1.KDFM	28.5	JONEZ.CAINEZ	ALT
4839/F145	CYV2/TBAKE.VTRY1.KDFM	8.6	JONEZ.CAINEZ	ALT
5239/F145	KCDFE/LBLS.VTRY1.KDFM	8.6	JONEZ.CAINEZ	ALT
1259/MHR2	CYV2/TBAKE.VTRY1.KDFM	8.8	JONEZ.CAINEZ	ALT



Send TMU Approve Unable Cancel Request Accept Reject



# DRAW Trial Planning: Multi-flight Trial Planning





# DRAW

Dynamic Routes for Arrival in Weather

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